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ANNOTATED LIST OF SPECIES

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PENSOFT

Fishes from the Río Alvarado drainage, Upper Río Magdalena Basin, Colombia

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Abstract

An annotated list of the freshwater fishes of the Río Alvarado drainage, Upper Río Magdalena Basin is presented. Fishes were captured from nine localities, quarterly sampled between September 2012 and July 2013. A total of 36 species belonging to 14 families, distributed in five orders were collected. The most abundant species was *Trichomycterus banneaui* (Eigenmann, 1912) (19.4%), followed by *Creagrutus affinis* Steindachner, 1880 (13%), *Chaetostoma thomsoni* Regan, 1904 (9.1%), *Trichomycterus mogotensis* Ardila-Rodríguez, 2017 (7.7%), *Astroblepus homodon* (Regan, 1904) (6.6%), *Creagrutus dulima* Albornoz-Garzón, Conde-Saldaña, García-Melo, Taphorn & Villa-Navarro, 2018 (5.9%), *Poecilia sphenops* Valenciennes, 1846 (5.7%) and *Argopleura magdalenensis* (Eigenmann, 1913) (5.6%). An identification key and a complete photographic catalog of all fish species recorded in the drainage are presented.

Keywords

Andes, Characiformes, fish diversity, identification key, Neotropical region, Siluriformes.

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Introduction

Currently the Magdalena-Cauca system harbors 217 valid species (DoNascimiento et al. 2019), many of which are endemic or are important for fisheries (Galvis and Mojica 2007; Anderson and Maldonado-Ocampo 2011). Historically, this basin has been subdivided in three stretches: Upper, Middle and Lower Magdalena Basin (Eigenmann 1920; Mojica and Franco 1990). Each region has its own hidromorphological and biological conditions (Mojica and Franco 1990; Forero-Medina and Joppa 2010). The Upper Magdalena is characterized by the lack of floodplains and has an area of 55,785 km^2, from its source in the La Magdalena lagoon at the Páramo de Las Papas (Huila department) to Los Raudales de Honda, in Tolima department, including some drainages with headwaters in Cauca and Cundinamarca departments. The Upper Magdalena Valley is dominated by Tropical Dry Forest ecosystem, with warm temperature (27 °C average) and a marked dry season (Villa-Navarro et al. 2006; Galvis and

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Mojica 2007; Forero-Medina and Joppa 2010; Romero-Duque et al. 2019). Likewise, this is a region with a high anthropogenic pressure due to landscape transformation, mainly cattle and agriculture activities (Forero-Medina and Joppa 2010).

The Upper Río Magdalena Basin is a region with a relatively well documented ichthyological knowledge in Colombia, which is reflected in the high variety of works published recently, life history studies (Villa-Navarro et al. 2014; Zúñiga-Upegui et al. 2014), patterns of community structure (Miranda et al. 2018; Montoya-Ospina et al. 2018; Poveda-Cuellar et al. 2018), ecomorphology (Conde-Saldaña et al. 2017), exotic species (Albornoz-Garzón and Villa-Navarro 2017), new species descriptions (Ortega-Lara et al. 2011; García-Alzate et al. 2015; García-Melo et al. 2016; Provenzano and Villa-Navarro 2017; Villa-Navarro et al. 2017; Albornoz-Garzón et al. 2018; García-Melo et al. 2018), karyotype descriptions (Conde-Saldaña et al. 2018, 2019a; Ibagón et al. 2020), and list of species (Villa-Navarro et al. 2006). However, our understanding of basic aspects of the fishes from small drainages in the Upper Magdalena is still limited. Taking this into consideration, we present an annotated list of fish species from the Río Alvarado drainage as a framework for future studies and as a guide for scientific and educational purposes, for the identification of fish species from Upper Río Magdalena Basin. A checklist, an identification key, and a complete photographic album of the fish species are provided.

Methods

Study area. This study was carried out in the Río Alvarado drainage (Upper Río Magdalena Basin), which is located on the eastern flank of the Cordillera Central, in Tolima Department, Colombia. The drainage has a length of 55 km, a drainage area of 29,988 ha (Conde-Saldaña et al. 2017), and flows into the Río Totare drainage. Nine sampling stations were established from 351 to 1,057 m elevation, distributed along the main channel (four stations) and in main tributaries (five stations) (Fig. 1, Table 1).

Sampling. Sampling campaigns were carried out quarterly, in an annual hydrological cycle, between September 2012 and July 2013. Fishes were collected using a backpack electrofisher (SAMUS model 725M). Electrofishing was performed in a single pass from downstream to upstream, with a variable width (depending on channel width), in a section of 100 m and a sampling effort of one hour. The specimens collected were anesthetized and euthanized with clove oil (300 mg/l), subsequently fixed in 10% formalin, and transferred to 70% ethanol after 48 h for final preservation.

The collected specimens were identified in the

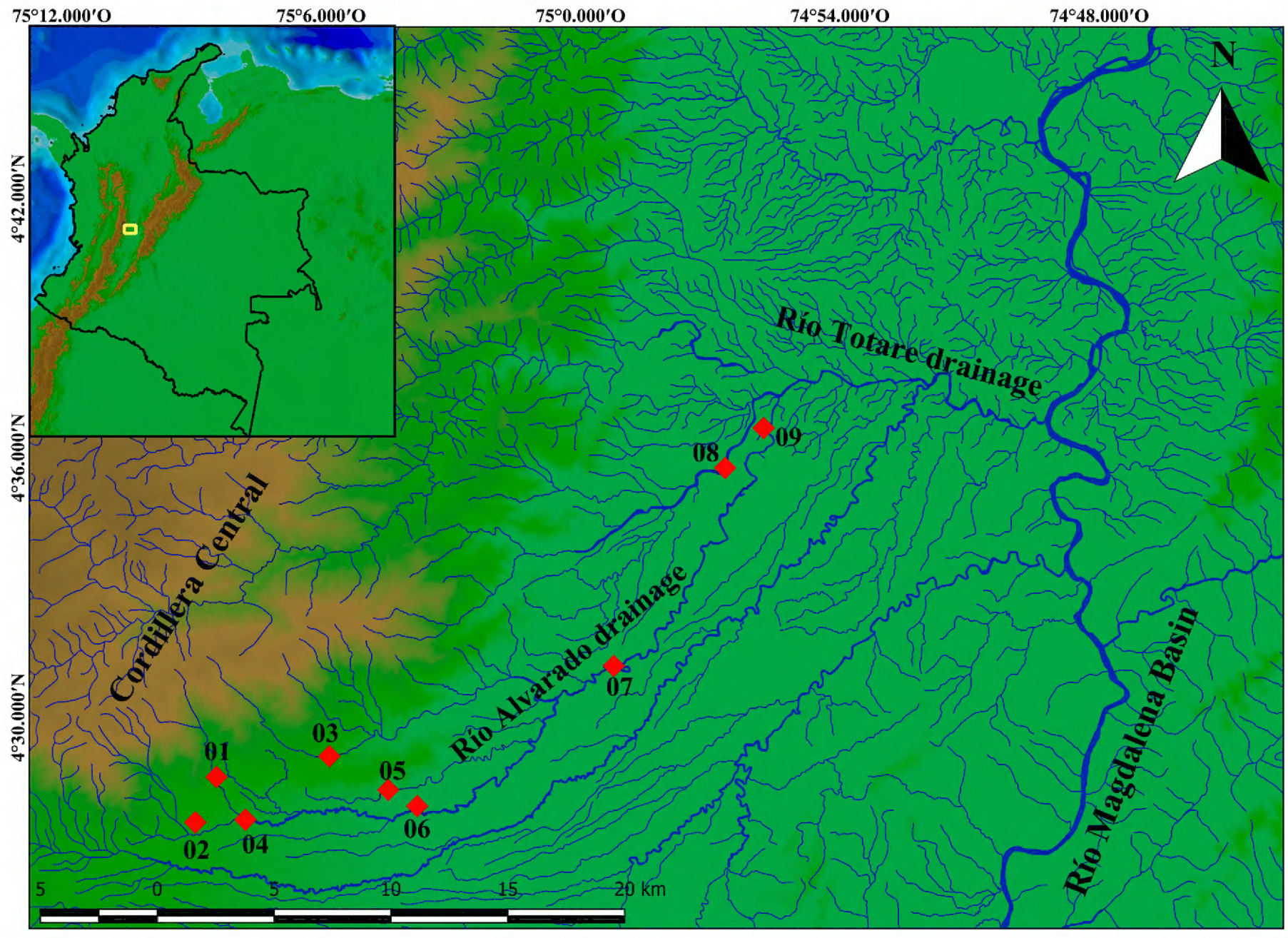

Figure 1. Map showing the study area and sampling localities in the Río Alvarado drainage, Upper Río Magdalena Basin, Colombia: 01: Quebrada Cocare; 02: Quebrada Chembe; 03: Quebrada Chumba; 04: Río Alvarado-El País; 05: Quebrada La Manjarres; 06: Río Alvarado-Chucuní; 07: Río Alvarado-El Puente; 08: Quebrada La Caima; and 09: Río Alvarado-Caldas Viejo (see Table 1 for detailed locality data).

Table. 1. Sampled localities in the Río Alvarado drainage, Upper Río Magdalena Basin, Colombia. ID = locality identification, see also Figure 1 and Table 2.

Locality	ID	Elevation (m)	Geographic coordinates	
			N	W
Quebrada Cocare	01	1,057	04°28′37.4″	075°08′25.4″
Quebrada Chembe	02	988	04°27′34.2″	075°08′54.7″
Quebrada Chumba	03	973	04°29′06.2″	075°05′48.6″
Río Alvarado-El País	04	909	04°27′37.9″	075°07′45.2″
Quebrada La Manjarres	05	758	04°28′19.3″	075°04′26.9″
Río Alvarado-Chucuní	06	697	04°27′56.7″	075°03′46.7″
Río Alvarado-Puente	07	521	04°31′11.3″	074°59′14.0″
Quebrada La Caima	08	374	04°35′45.8″	074°56′39.6″
Río Alvarado-Caldas Viejo	09	351	04°36′41.2″	074°55′46.2″

laboratory, using literature such as Eigenmann (1912, 1913, 1917, 1918, 1921, 1922), Eigenmann and Fisher (1914), Eigenmann et al. (1914), Eigenmann and Henn (1916), Miles (1947), Dahl (1971), Harold and Vari (1994), Maldonado-Ocampo et al. (2005), de Santana and Maldonado-Ocampo (2005), Román-Valencia et al. (2008, 2013), Londoño-Burbano et al. (2011), Ortega-Lara et al. (2011), Vanegas-Ríos (2016), Villa-Navarro et al. (2017), Londoño-Burbano and Reis (2019), and Albornoz-Garzón et al. (2018). Finally, specimens were deposited in the ichthyological collection of the Universidad del Tolima, Tolima, Colombia (CZUT-IC). The catalog numbers are provided in the Table 2. Measurements are expressed as percentages of total length (TL), standard length (SL), head length (HL) or length to the end of the anal fin (LEA).

Results

A total of 7,201 specimens were collected, distributed in 36 species, 14 families and five orders. The most abundant orders were Siluriformes (52.8%) and Characiformes (35.3%). The families with the highest abundance were Characidae (33.2%), followed by Trichomycteridae (27.2%) and Loricariidae (16.2%). The most abundant species were *Trichomycterus banneaui* (Eigenmann) (19.4%), *Creagrutus affinis* Steindachner (13%), *Chaetostoma thomsoni* Regan (9.1%), *Trichomycterus mogotensis* Ardila-Rodríguez (7.7%), *Astroblepus homodon* (Regan) (6.6%), *Creagrutus dulima* Albornoz-Garzón, Conde-Saldaña, García-Melo, Taphorn & Villa-Navarro (5.9%), *Poecilia sphenops* Valenciennes, 1846 (5.7%) and *Argopleura magdalenensis* (Eigenmann) (5.6%). The remaining species represented less than 1% of abundance.

Characidium phoxocephalum Eigenmann is categorized as Vulnerable, and *Kronoheros umbrifer* Meek & Hildebrand, *Hypostomus* (*Cochliodon*) *hondae* Regan, and *Microgenys minuta* Eigenmann as Near Threatened. Likewise, except for *Poecilia reticulata* Peters, 1859 and *P. sphenops* Valenciennes, 1846, remaining species are native to the Río Magdalena Basin. An identification key and photographs for all recorded species are herein provided (Figs 2–4).

Order Characiformes
Family Crenuchidae

Characidium phoxocephalum Eigenmann, 1912

Figure 2A

Material examined. COLOMBIA • 1, 74.03 mm SL; Río Alvarado-El País; 04°27′37.9″N, 075°07′45.2″W; 909 m a.s.l.; 04 Apr. 2013; Cristhian C. Conde-Saldaña, Juan G. Albornoz-Garzón leg.; CZUT-IC 10638.

Identification. Isthmus and chest scaled. A dark mid-lateral stripe from snout to middle caudal-fin rays. Black spots located on, above and below a dark lateral stripe. Dorsum crossed by 7 to 10 vertical bars that do not reach below lateral stripe (Eigenmann 1912; Agudelo-Zamora et al. 2020).

Family Erythrinidae

Hoplias malabaricus (Bloch, 1794)

Figure 2B

Material examined. COLOMBIA • 2, 101.4–120.2 mm SL; Río Alvarado-Puente; 04°31′11.3″N, 074°59′14.0″W; 521 m a.s.l.; 19 Sep. 2012; Juan G. Albornoz-Garzón, Cristhian C. Conde-Saldaña leg.; CZUT-IC 10194. • 6, 121.6–161.8 mm SL; Río Alvarado-Caldas Viejo; 04°36′41.2″N, 075°55′46.2″W; 351 m a.s.l.; 12 Dec. 2012; Juan G. Albornoz-Garzón, Cristhian C. Conde-Saldaña leg.; CZUT-IC 10346.

Identification. Dentaries abruptly converging towards the mandibular symphysis. Bony tooth plates on the basihyal. Dark chevron pattern along the sides of body. A dark mid-lateral band extending along entire length of lateral line, in larger specimens this band is missing (Mattox et al. 2014).

Family Parodontidae

Parodon magdalenensis Londoño-Burbano, Román-Valencia & Taphorn, 2011

Figure 2C

Material examined. COLOMBIA • 7, 52.9–121.6 mm SL; Quebrada La Caima; 04°35′45.8″N, 074°56′39.6″W; 374 m a.s.l.; 19 Sep. 2012; Cristhian C. Conde-Saldaña, Juan G. Albornoz-Garzón leg.; CZUT-IC 10112. • 13, 73.3–121.7 mm SL; Quebrada La Caima; 04°35′45.8″N, 074°56′39.6″W; 374 m a.s.l.; 12 Dec. 2012; Juan G. Albornoz-Garzón, Cristhian C. Conde-Saldaña leg.; CZUT-IC 10368.

Identification. A broad dark mid-lateral stripe above lateral line from snout to tips of middle caudal-fin rays. Body with dark ground portion above black lateral stripe lacking projections or spots extending dorsally, base color below lateral stripe to level of axillary scale gray. Adults with a well-defined black spot from middle of pectoral fin to its tip. Brown spots absent on dorsal part of sides above lateral stripe (Londoño-Burbano et al. 2011).

Table 2. List of species from Río Alvarado drainage, Upper Río Magdalena Basin, Colombia. Fig. = reference to figure. CZUT-IC = catalog number of voucher specimens. * = threatened species; ** = non-native species.

Species	Locality									Fig.	CZUT-IC
	1	2	3	4	5	6	7	8	9		
Characiformes											
Crenuchidae										2A	
Characidium phoxocephalum Eigenmann, 1912*				X							10638
Erythrinidae											
Hoplias malabaricus (Bloch, 1794)					X	X	X	X	X	2B	10346
Parodontidae											
Parodon magdalenensis Londoño-Burbano, Román-Valencia & Taphorn, 2011								X		2C	10368
Characidae											
Astyanax sp.								X	X	2D	10555
Argopleura magdalenensis (Eigenmann, 1913)						X	X	X	X	2E	10150
Creagrutus affinis Steindachner, 1880						X	X	X	X	2F	10078
Creagrutus dulima Albornoz-Garzón, Conde-Saldaña, García-Melo, Taphorn & Villa-Navarro, 2018	X	X	X	X		X		X		2G	10225
Creagrutus magdalenae Eigenmann, 1913								X	X	2H	10060
Gephyrocharax melanocheir Eigenmann, 1912					X		X	X	X	2I	10706
Hemibrycon sp.							X			2J	10790
Microgenys minuta Eigenmann, 1913*							X	X	X	2K	10335
Roeboides dayi (Steindachner, 1878)									X	2L	10536
Siluriformes											
Heptapteridae											
Cetopsorhamdia molinae Miles, 1943									X	3A	10087
Pimelodella floridablancaensis Ardila-Rodríguez, 2017				X		X	X	X	X	3B	10197
Rhamdia guatemalensis (Günther, 1864)					X		X	X	X	3C	10351
Heptapteridae undescribed						X	X	X	X	3D	10417
Pimelodidae											
Pimelodus yuma Villa-Navarro & Acero, 2017									X	3E	10352
Trichomycteridae											
Trichomycterus banneaui (Eigenmann, 1912)	X	X	X	X	X	X	X	X	X	3F	10106
Trichomycterus transandianus (Steindachner, 1915)	X	X	X							3G	10850
Trichomycterus mogotensis Ardila-Rodríguez, 2017	X	X	X	X	X	X		X		3H	10254
Loricariidae											
Chaetostoma milesi Fowler, 1941						X	X	X	X	3I	10593
Chaetostoma thomsoni Regan, 1904			X	X		X	X	X	X	3J	10121
Hypostomus (*Cochliodon*) *hondae* (Regan, 1912)*						X	X	X	X	3K	10766
Lasiancistrus caucanus Eigenmann, 1912						X	X	X	X	3L	10123
Sturisomatichthys leightoni (Regan, 1912)				X		X	X	X	X	4A	10063
Astroblepidae											
Astroblepus grixalvii Humboldt, 1805	X	X								4B	10500
Astroblepus homodon (Regan, 1904)	X	X	X	X	X	X				4C	10666
Astroblepus sp.	X									4D	10502
Gymnotiformes											
Sternopygidae											
Sternopygus aequilabiatus Humboldt, 1805								X	X	4E	10367
Apteronotidae											
Apteronotus eschmeyeri de Santana, Maldonado-Ocampo, Severi & Mendes, 2004									X	4F	10692
Cyprinodontiformes											
Rivulidae											
Rivulus (*Cynodonichthys*) *magdalenae* Eigenmann & Henn, 1916	X	X	X	X						4G	10208
Poeciliidae											
Poecilia reticulata Peters, 1859**	X	X	X	X	X					4H	10434
Poecilia sphenops Valenciennes, 1846**						X		X	X	4I	10126
Cichliformes											
Cichlidae											
Andinoacara latifrons (Steindachner, 1878)							X	X	X	4J	10582
Geophagus steindachneri Eigenmann & Hildebrand, 1910				X	X	X	X	X	X	4K	10111
Kronoheros umbrifer (Meek & Hildebrand, 1913)*							X		X	4L	10716

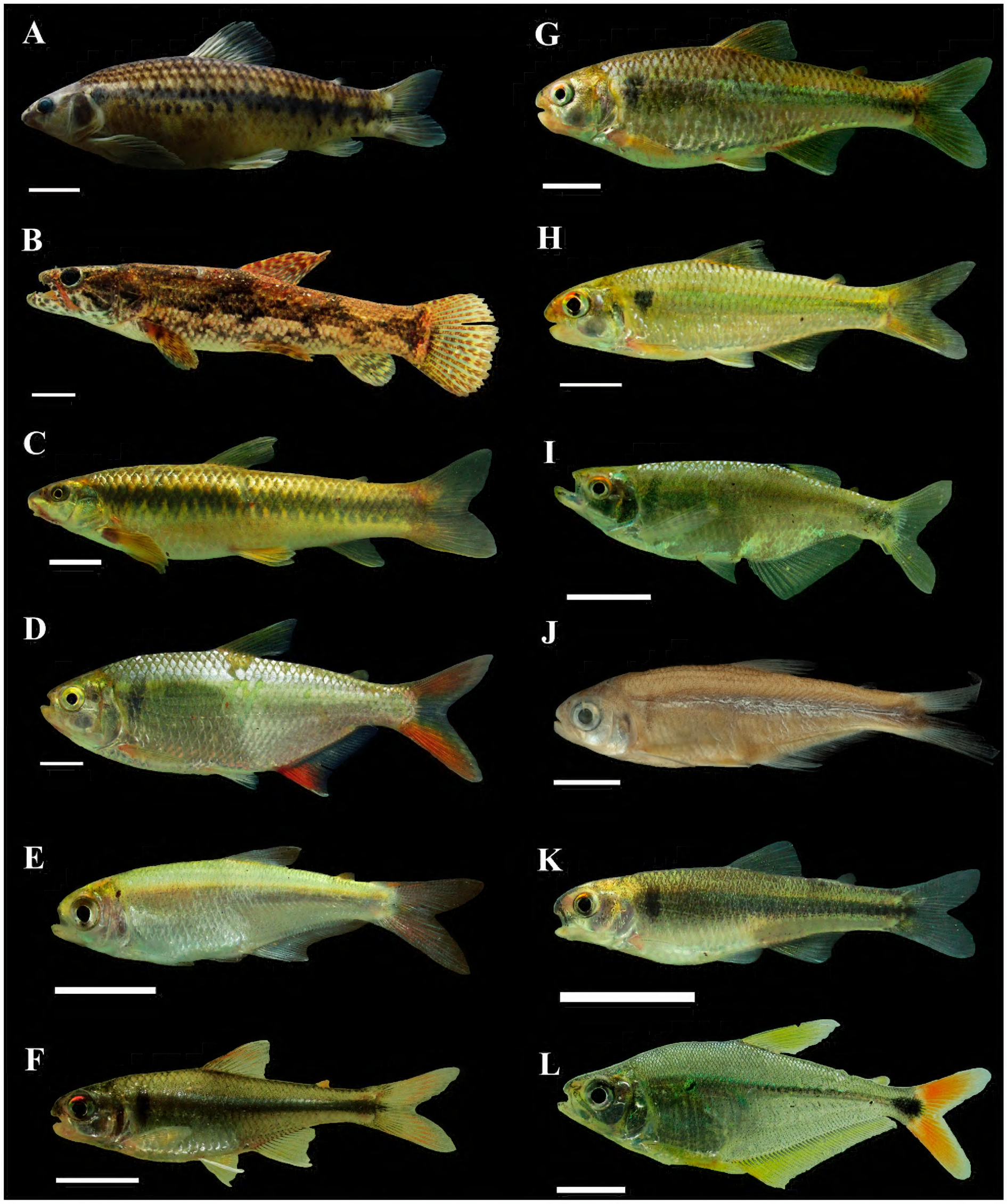

Figure 2. Characiform fishes from Río Alvarado drainage, Upper Río Magdalena Basin, Colombia. **A.** *Characidium phoxocephalum*. **B.** *Hoplias malabaricus*. **C.** *Parodon magdalenensis*. **D.** *Astyanax* sp. **E.** *Argopleura magdalenensis*. **F.** *Creagrutus affinis*. **G.** *Creagrutus dulima*. **H.** *Creagrutus magdalenae*. **I.** *Gephyrocharax melanocheir*. **J.** *Hemibrycon* sp. **K.** *Microgenys minuta*. **L.** *Roeboides dayi*. Scale bars: 10 mm.

Family Characidae

***Astyanax* sp.**
Figure 2D

Material examined. COLOMBIA • 6, 75.9–101.9 mm SL; Quebrada La Caima; 04°35′45.8″N, 074°56′39.6″W; 374 m a.s.l.; 12 Dec. 2012; Juan G. Albornoz-Garzón, Cristhian C. Conde-Saldaña leg.; CZUT-IC 10369. • 13, 49.9–107.2 mm SL; Quebrada La Caima; 04°35′45.8″N, 074°56′39.6″W; 374 m a.s.l.; 4 Apr. 2013; Juan G. Albornoz-Garzón, Cristhian C. Conde-Saldaña leg.; CZUT-IC 10555.

Identification. Lateral line with 39–43 pored scales. Anal fin with 24–27 branched rays. Caudal fin with upper lower lobe longer than upper lobe. Body coloration silvery, with greenish tone on dorsal region of head and

humeral region. Dark humeral blotch, vertically elongated. Dorsal-fin rays yellow. Pectoral and pelvic-fin rays hyaline. Anteriormost anal-fin rays reddish, with distal tips white. Caudal-fin rays reddish with yellow to light green tone. Adipose fin greenish.

***Argopleura magdalenensis* (Eigenmann, 1913)**
Figure 2E

Material examined. COLOMBIA • 65, 23.4–38.8 mm SL; Quebrada La Caima; 04°35′45.8″N, 074°56′39.6″W; 374 m a.s.l.; 19 Sep. 2012; Cristhian C. Conde-Saldaña, Juan G. Albornoz-Garzón leg.; CZUT-IC 10150. • 44, 17.6–44.2 mm SL; Quebrada La Caima; 04°35′45.8″N, 074°56′39.6″W; 374 m a.s.l.; 4 Apr. 2013; Juan G. Albornoz-Garzón, Cristhian C. Conde-Saldaña leg.; CZUT-IC 10556.

Identification. Maxillary not reaching suture between first and second infraorbital. Lateral line with 40–43 pored scales. Five scales between the dorsal-fin origin and the lateral line. Anal fin with 33–37 branched rays. A bright mid-lateral stripe extending from humeral region to caudal peduncle (Eigenmann 1913).

***Creagrutus affinis* Steindachner, 1880**
Figure 2F

Material examined. COLOMBIA • 12, 28.9–43.8 mm SL; Río Alvarado-Caldas Viejo; 04°36′41.2″N, 074° 55′46.2″W; 351 m a.s.l.; 19 Sep. 2012; Cristhian C. Conde-Saldaña, Juan G. Albornoz-Garzón leg.; CZUT-IC 10078. • 17, 25.9–44.7 mm SL; Quebrada La Caima; 04°35′45.8″N, 074°56′39.6″W; 374 m a.s.l.; 19 Sep. 2012; Cristhian C. Conde-Saldaña, Juan G. Albornoz-Garzón leg.; CZUT-IC 10139.

Identification. Third infraorbital in contact with the preopercle. Lateral line complete, with 35–38 pored scales. No lamellar flaps over pores of lateral line scales. Anal fin short with 11–13 branched rays. Dark humeral blotch vertically elongated. Middle caudal-fin rays with a dark horizontal stripe (Harold and Vari 1994; Albornoz-Garzón et al. 2018).

***Creagrutus dulima* Albornoz-Garzón, Conde-Saldaña, García-Melo, Taphorn & Villa-Navarro, 2018**
Figure 2G

Material examined. COLOMBIA • 10, 30.7–65.8 mm SL; Río Alvarado-Chucuní; 04°27′56.7″N, 075°03′46.7″ W; 697 m a.s.l.; 19 Sep. 2012; Juan G. Albornoz-Garzón, Cristhian C. Conde-Saldaña leg.; CZUT-IC 10225. • 20, 29.3–56.3 mm SL; Río Alvarado-El País; 04° 27′37.9″N, 075°07′45.2″W; 909 m a.s.l.; 19 Sep. 2012; Juan G. Albornoz-Garzón, Cristhian C. Conde-Saldaña leg.; CZUT-IC 10368.

Identification. Third infraorbital not in contact with the preopercle. Lateral line complete, with 35–38 pored scales. No lamellar flaps over pores of lateral line scales. Anal fin short with 9–12 branched rays. Pelvic fins with short hooks on rays (usually shorter than the width of the branched rays). Eye diameter: 21.8–26.8% HL. Body with dorsal portion with dark reticulated pattern formed by pigmentation concentrated on distal portion of scales. Dark humeral blotch vertically elongated. Middle caudal-fin rays without a dark horizontal stripe (Albornoz-Garzón et al. 2018).

***Creagrutus magdalenae* Eigenmann, 1913**
Figure 2H

Material examined. COLOMBIA • 16, 53.1–79.4 mm SL; Río Alvarado-Caldas Viejo; 04°36′41.2″N, 074°55′ 46.2″W; 351 m a.s.l.; 19 Sep. 2012; Juan G. Albornoz-Garzón, Cristhian C. Conde-Saldaña leg.; CZUT-IC 10060. • 6, 55.8–66.6 mm SL; Quebrada La Caima; 04°35′45.8″N, 074°56′39.6″W; 374 m a.s.l.; 19 Dec. 2012; Juan G. Albornoz-Garzón, Cristhian C. Conde-Saldaña leg.; CZUT-IC 10372.

Identification. Third infraorbital in contact with the preopercle. Lateral line complete, with 34–37 pored scales. No lamellar flaps over pores of lateral line scales. Anal fin short with 9–11 branched rays. Caudal-peduncle depth (12.6–15.9% SL). Dark humeral blotch ovoid. Middle caudal-fin rays without a dark horizontal stripe (Harold and Vari 1994; Albornoz-Garzón et al. 2018).

***Gephyrocharax melanocheir* Eigenmann, 1912**
Figure 2I

Material examined. COLOMBIA. • 7, 31.3–35.3 mm SL; Río Alvarado-Caldas Viejo; 04°36′41.2″N, 074°55′46.2″W; 351 m a.s.l.; 28 Jun. 2013; Cristhian C. Conde-Saldaña, Juan G. Albornoz-Garzón leg.; CZUT-IC 10706. • 7, 36.6–37.5 mm SL; Quebrada La Manjarres; 04°28′19.3″N, 075°04′26.9″W; 758 m a.s.l.; 28 Jun. 2013; Juan G. Albornoz-Garzón, Cristhian C. Conde-Saldaña leg.; CZUT-IC 10788.

Identification. Outermost branched pectoral-fin ray of adult males with a fan-shaped structure distally formed. Bony hooks and a dark blotch present distally in the fan-shaped structure. Caudal-fin rays 10th and 11th lacking of terminal lateral-line tube. Adult males with a long gill gland (7.0–11.4% SL). Urogenital papillae developed in adult females. An intense dark pigmentation at the base of the five anterior dorsal-fin rays (Vanegas-Ríos 2016).

***Hemibrycon* sp.**
Figure 2J

Material examined. COLOMBIA • 1, 53.7 mm SL; Río Alvarado-Puente; 04°31′11.3″N, 074°59′14.0″W; 521 m a.s.l.; 28 Jun. 2013; Cristhian C. Conde-Saldaña, Juan G. Albornoz-Garzón leg.; CZUT-IC 10790.

Identification. The identification was based on a single specimen in poorly preserved condition. Body deep (28.9% SL). Distance between dorsal and anal fin origins (29.1% SL). Head length (23.6% SL). Snout length (17.8% HL). Premaxilla with two rows of teeth. Anal fin with 26 branched rays. Dark humeral blotch vertically elongated. A silvery mid-lateral stripe extending from

humeral region to caudal peduncle. Middle caudal-fin rays with a dark horizontal stripe.

***Microgenys minuta* Eigenmann, 1913**
Figure 2K

Material examined. COLOMBIA • 7, 24.5–34.5 mm SL; Río Alvarado-Caldas Viejo; 04°36′41.2″N, 074°55′46.2″W; 351 m a.s.l.; 12 Dec. 2012; Cristhian C. Conde-Saldaña, Juan G. Albornoz-Garzón leg.; CZUT-IC 10335. • 22, 26.2–32.9 mm SL; Quebrada La Caima; 04°35′45.8″N, 074°56′39.6″W; 374 m a.s.l.; 4 Apr. 2013; Juan G. Albornoz-Garzón, Cristhian C. Conde-Saldaña leg.; CZUT-IC 10569.

Identification. Lateral line with 30–35 pored scales. Dorsal-fin origin equidistant from the tip of snout and the base of the caudal rays. Anal fin short with 9–10 branched rays. Dark humeral blotch vertically elongate. A dark silvery mid-lateral stripe extending from humeral region to caudal peduncle (Eigenmann 1913).

***Roeboides dayi* (Steindachner, 1878)**
Figure 2L

Material examined. COLOMBIA • 1, 49.1 mm SL; Río Alvarado-Caldas Viejo; 04°36′41.2″N, 074°55′46.2″W; 351 m a.s.l.; 04 Apr. 2013; Cristhian C. Conde-Saldaña, Juan G. Albornoz-Garzón leg.; CZUT-IC 10536. • 1, 48.8 mm SL; Río Alvarado-Caldas Viejo; 04°36′41.2″N, 074°55′46.2″W; 351 m a.s.l.; 28 Jun. 2013; Cristhian C. Conde-Saldaña, Juan G. Albornoz-Garzón leg.; CZUT-IC 10680.

Identification. Lateral line with 53–60 pored scales. Scales below lateral line 13 to 18. Anal fin with 44–47 branched rays. Dark humeral blotch ovoid present. Caudal peduncle with a conspicuous tear-drop shaped spot (Lucena 2000).

Order Siluriformes
Family Heptapteridae

***Cetopsorhamdia molinae* Miles, 1943**
Figure 3A

Material examined. COLOMBIA • 2, 29.6–41.2 mm SL; Río Alvarado-Caldas Viejo; 04°36′41.2″N, 074°55′46.2″W; 351 m a.s.l.; 19 Sep. 2012; Cristhian C. Conde-Saldaña, Juan G. Albornoz-Garzón leg.; CZUT-IC 10087. • 1, 32.0 mm SL; Río Alvarado-Caldas Viejo; 04°36′41.2″N, 074°55′46.2″W; 351 m a.s.l.; 12 Dec. 2012; Cristhian C. Conde-Saldaña, Juan G. Albornoz-Garzón leg.; CZUT-IC 10331.

Identification. Body slender and slightly short. Body deep (19.5–19.5% SL). Head length: 23.1–27.6% SL. Maxillary barbel not reaching pelvic-fin origin. Adipose fin relatively short (18.6–19.3% SL) and triangle-shaped. Insertion of the adipose fin equidistant between dorsal and caudal fins. Caudal fin forked with both lobes pointed. Body brown with four conspicuous pale dorsal transverse bands: one around posterior region of the head, one in front of the dorsal fin, one anterior to adipose fin, and one around the caudal peduncle (Miles 1943).

***Pimelodella floridablancaensis* Ardila Rodríguez, 2017**
Figure 3B

Material examined. COLOMBIA • 11, 47.4–97.9 mm SL; Río Alvarado-Puente; 04°31′11.3″N, 074°59′14.0″W; 521 m a.s.l.; 19 Sep. 2012; Juan G. Albornoz-Garzón, Cristhian C. Conde-Saldaña leg.; CZUT-IC 10197. • 3, 55.9–76.6 mm SL; Quebrada La Caima; 04°35′45.8″N, 074°56′39.6″W; 374 m a.s.l.; 12 Dec. 2012; Juan G. Albornoz-Garzón, Cristhian C. Conde-Saldaña leg.; CZUT-IC 10379.

Identification. Body moderately elongate. Maxillary barbel reaching anal-fin origin, surpassing anal-fin in some specimens. Greater maximum depth of dentations on the posterior margin of the pectoral-fin spine, 1.71–2.90 times in the width of the spine at its base. Distal posterior margin of pectoral-fin spine without dentations, 32.2–52% in pectoral-fin spine length. Adipose fin relatively long (22.6–35.8% SL) and deep (3.5–6.7% SL), forming elevated curve in lateral profile. Insertion of adipose fin equidistant between dorsal and caudal fins. Caudal fin forked with both lobes pointed, lower lobe slightly shorter than upper lobe. Body light brown. A dark brown mid-lateral stripe well defined, extending from snout to base of middle caudal-fin rays (Ardila-Rodríguez 2017a; Conde-Saldaña et al. 2019b).

***Rhamdia guatemalensis* (Günther, 1864)**
Figure 3C

Material examined. COLOMBIA • 3, 149.0–164.7 mm SL; Río Alvarado-Caldas Viejo; 04°36′41.2″N, 074°55′46.2″W; 351 m a.s.l.; 12 Dec. 2012; Cristhian C. Conde-Saldaña, Juan G. Albornoz-Garzón leg.; CZUT-IC 10351. • 1, 125.8 mm SL; Quebrada La Caima; 04°35′45.8″N, 074°56′39.6″W; 374 m a.s.l.; 12 Dec. 2012; Juan G. Albornoz-Garzón, Cristhian C. Conde-Saldaña leg.; CZUT-IC 10380.

Identification. Body moderately elongated and relatively deep. Maxillary barbel parallel to main body axis, crossing the pelvic-fin insertion. Dorsal-fin base (14.4–19.4% SL). Adipose fin long (35.9–43.2% SL) and deep (4.1–7.5% SL), forming elevated curve in lateral profile. Insertion of the adipose fin closer to the dorsal fin than to the caudal fin. Caudal fin forked with both lobes rounded, lower lobe slightly longer than upper lobe. Body usually brown. In some specimens a dark lateral stripe along the lateral line is present (Hernández et al. 2015).

Heptapteridae undescribed
Figure 3D

Material examined. COLOMBIA • 3, 44.3–62.0 mm SL; Río Alvarado-Puente; 04°31′11.3″N, 074°59′14.0″W; 521 m a.s.l.; 12 Dec. 2012; Cristhian C. Conde-Saldaña, Juan G. Albornoz-Garzón leg.; CZUT-IC 10417. • 2, 40.9–42.4 mm SL; Río Alvarado-Chucuní; 04°27′56.7″N,

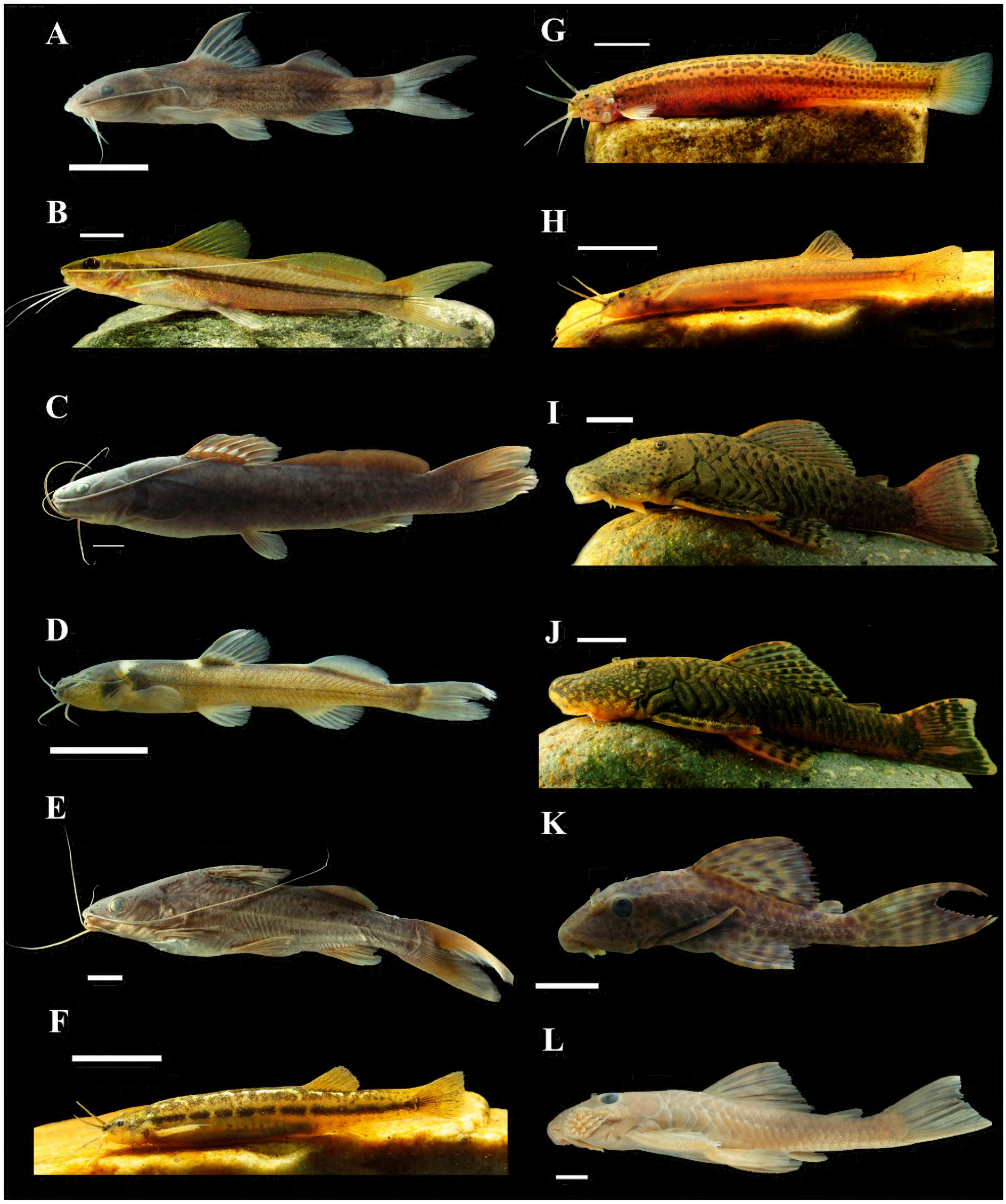

Figure 3. Siluriform fishes from Río Alvarado drainage, Upper Río Magdalena Basin, Colombia. **A.** *Cetopsorhamdia molinae*. **B.** *Pimelodella floridablancaensis*. **C.** *Rhamdia guatemalensis*. **D.** Heptapteridae undescribed. **E.** *Pimelodus yuma*. **F.** *Trichomycterus banneaui*. **G.** *Trichomycterus transandianus*. **H.** *Trichomycterus mogotensis* **I.** *Chaetostoma milesi*. **J.** *Chaetostoma thomsoni*. **K.** *Hypostomus* (*Cochliodon*) *hondae*. **L.** *Lasiancistrus caucanus*. Scale bars: 10 mm.

075°03′46.7″W; 697 m a.s.l.; 13 Dec. 2012; Cristhian C. Conde-Saldaña, Juan G. Albornoz-Garzón leg.; CZUT-IC 10452.

Identification. Body moderately elongated. Body deep (9.2–16.6% SL). Cleithral width: 14.0–18.8% SL. Head length: 18.4–22.1% SL. Maxillary barbel reaching pectoral-fin insertion. Adipose fin rounded (17.6–30.2% SL, its origin anterior to anal-fin; adipose-fin origin equidistant between dorsal and caudal fins). Adipose-fin depth (2.2–4.6% SL). Caudal fin forked with both lobes rounded, upper lobe longer than lower lobe. Body brown with scattered minute melanophores along body. A conspicuous pale collar around posterior region of head and pale blotch in front of dorsal fin. Fins hyaline.

Family Pimelodidae

***Pimelodus yuma* Villa-Navarro & Acero, 2017**
Figure 3E

Material examined. COLOMBIA • 3, 119.7–130.2 mm SL; Río Alvarado-Caldas Viejo; 04°36′41.2″N, 074° 55′46.2″W; 351 m a.s.l.; 12 Dec. 2012; Cristhian C. Conde-Saldaña, Juan G. Albornoz-Garzón leg.; CZUT-IC 10352 • 2, 117.9–138.1 mm SL; Río Alvarado-Caldas Viejo; 04°36′41.2″N, 074°55′46.2″W; 351 m a.s.l.; 12 Dec. 2012; Cristhian C. Conde-Saldaña, Juan G. Albornoz-Garzón leg.; CZUT-IC 10366.

Identification. Predorsal distance (34.9–38.9% SL). Preventral distance (42.1–47.0% SL). Adipose-fin length (16.4–20.3% SL). Dorsal–adipose distance (16.6–22.5% SL). Interorbital width (36.2–42.8% HL). Body gray without spots or stripes (Villa-Navarro et al. 2017).

Family Trichomycteridae

***Trichomycterus banneaui* (Eigenmann, 1912)**
Figure 3F

Material examined. COLOMBIA • 19, 18.2–37.3 mm SL; Río Alvarado-Caldas Viejo; 04°36′41.2″N, 074°55′ 46.2″W; 351 m a.s.l.; 19 Sep. 2012; Cristhian C. Conde-Saldaña, Juan G. Albornoz-Garzón leg.; CZUT-IC 10106. • 8, 21.3–45.0 mm SL; Río Alvarado-Puente; 04° 31′11.3″N, 074°59′14.0″W; 521 m a.s.l.; 19 Sep. 2012; Juan G. Albornoz-Garzón, Cristhian C. Conde-Saldaña leg.; CZUT-IC 10168.

Identification. Relatively small body size (largest specimen 47 mm SL). Head triangular in dorsal view. Premaxilla with 27 conical teeth arranged in two or three irregular rows. Dentary with 30 conical teeth arranged in three of four irregular rows. Interopercle with 26 odontodes. Opercle with 23 to 29 odontodes. Pectoral fin with seven branched rays. Caudal fin emarginated. Body light yellow with predorsal and horizontal mid-lateral rows of large blotches (García-Melo 2009).

***Trichomycterus transandianus* (Steindachner, 1915)**
Figure 3G

Material examined. COLOMBIA • 19, 18.2–37.3 mm SL; Río Alvarado-Caldas Viejo; 04°36′41.2″N, 074° 55′46.2″W; 351 m a.s.l.; 19 Sep. 2012; Cristhian C. Conde-Saldaña, Juan G. Albornoz-Garzón leg.; CZUT-IC 10106. • 8, 21.3–45.0 mm SL; Río Alvarado-Puente; 04° 31′11.3″N, 074°59′14.0″W; 521 m a.s.l.; 19 Sep. 2012; Juan G. Albornoz-Garzón, Cristhian C. Conde-Saldaña leg.; CZUT-IC 10168.

Identification. Relatively medium body size (largest specimen 75 mm SL). Head squared in dorsal view. Premaxilla with 32 incisiform teeth arranged in two regular rows. Dentary with 40 incisiform teeth arranged in two regular rows. Interopercle with 39 odontodes. Opercle with 15 odontodes. Pectoral fin with six branched rays. Caudal fin rounded. Body light brown, lighter ventrally. Dorsal region of body with light brown blotches and dots, irregularly distributed; a light brown midlateral stripe present, extending from behind opercle to caudal-fin base, becoming diffuse in larger specimens (García-Melo 2009).

***Trichomycterus mogotensis* Ardila-Rodríguez, 2017**
Figure 3H

Material examined. COLOMBIA • 12, 25.7–75.8 mm SL; Río Alvarado-El País; 04°27′37.9″N, 075°07′45.2″W; 909 m a.s.l.; 19 Sep. 2012; Cristhian C. Conde-Saldaña, Juan G. Albornoz-Garzón leg.; CZUT-IC 10254. • 16, 24.8–54.3 mm SL; Quebrada Chumba; 04°29′06.2″N, 075°05′48.6″W; 973 m a.s.l.; 20 Sep. 2012; Juan G. Albornoz-Garzón, Cristhian C. Conde-Saldaña leg.; CZUT-IC 10282.

Identification. Relatively medium body size (largest specimen 85 mm SL). Head triangular in dorsal view. Premaxilla with 37 conical teeth arranged in three irregular rows; dentary with conical 37 teeth arranged in three irregular rows. Interopercle with 37 odontodes. Opercle with 23 odontodes. Pectoral fin with seven branched rays. Caudal fin emarginated. Body brown with dark diffuse dots on dorsum and dorsolateral region of trunk (García-Melo 2009; Ardila-Rodríguez 2017b).

Family Loricariidae

***Chaetostoma milesi* Fowler, 1941**
Figure 3I

Material examined. COLOMBIA • 8, 34.1–94.7 mm SL; Río Alvarado-Chucuní; 04°27′56.7″N, 075°03′46.7″W; 697 m a.s.l.; 13 Dec. 2012; Juan G. Albornoz-Garzón, Cristhian C. Conde-Saldaña leg.; CZUT-IC 10450. • 23, 33.1–101.2 mm SL; Río Alvarado-Puente; 04°31′11.3″N, 074°59′14.0″W; 521 m a.s.l.; 4 Apr. 2013; Juan G. Albornoz-Garzón, Cristhian C. Conde-Saldaña leg.; CZUT-IC 10593.

Identification. Distal portion of snout without plates. Caudal peduncle with five rows of plates. Caudal fin emarginated with lower portion longer than upper portion. Black spots on head and body. Fins with scattered dark spots. Caudal fin uniformly dusky, with undulated dark stripe along distal margin (Fowler 1941; Miles 1947).

***Chaetostoma thomsoni* Regan, 1904**
Figure 3J

Material examined. COLOMBIA • 66, 23.0–69.2 mm SL; Quebrada La Caima; 04°35′45.8″N, 074°56′39.6″W; 374 m a.s.l.; 19 Sep. 2012; Cristhian C. Conde-Saldaña, Juan G. Albornoz-Garzón leg.; CZUT-IC 10121. • 14, 25.5–97.1 mm SL; Río Alvarado-Chucuní; 04°27′56.7″N, 075°03′46.7″W; 697 m a.s.l.; 19 Sep. 2012; Juan G. Albornoz-Garzón, Cristhian C. Conde-Saldaña leg.; CZUT-IC 10219.

Identification. Distal portion of snout without plates. Interoperculum with four to five odontodes. Caudal peduncle with five rows of plates. Anal fin rays I, 5. Caudal fin

emarginated with lower portion longer than upper portion. Light spots usually concentrated on head. Fins with white to yellow bands. Distal margin along caudal fin pale, more evident at tips (Regan 1904).

***Hypostomus* (*Cochliodon*) *hondae* (Regan, 1912)**
Figure 3K

Material examined. COLOMBIA • 1, 53.9 mm SL; Río Alvarado-Caldas Viejo; 04°36′41.2″N, 074°55′46.2″W; 351 m a.s.l.; 28 Jun. 2013; Cristhian C. Conde-Saldaña, Juan G. Albornoz-Garzón leg.; CZUT-IC 10697. • 2, 24.2–49.7 mm SL; Río Alvarado-Puente; 04°31′11.3″N, 074°59′14.0″W; 521 m a.s.l.; 28 Jun. 2013; Cristhian C. Conde-Saldaña, Juan G. Albornoz-Garzón leg.; CZUT-IC 10766.

Identification. Mouth with spoon-shaped teeth. Plates in the skin between the dorsal fin and the lateral plates anterior of the dorsal-fin spine 1 to more of 6. Pectoral-fin spine reach 2–3 plates beyond the pelvic fin when depressed ventrally to the pelvic fin. Caudal-fin spines with spots (Armbruster 2003).

***Lasiancistrus caucanus* Eigenmann, 1912**
Figure 3L

Material examined. COLOMBIA • 5, 29–74.2 mm SL; Río Alvarado-Caldas Viejo; 04°36′41.2″N, 074°55′46.2″W; 351 m a.s.l.; 19 Sep. 2012; Cristhian C. Conde-Saldaña, Juan G. Albornoz-Garzón leg.; CZUT-IC 10065. • 3, 30.2–33.1 mm SL; Quebrada La Caima; 04°35′45.8″N, 074°56′39.6″W; 374 m a.s.l.; 19 Sep. 2012; Cristhian C. Conde-Saldaña, Juan G. Albornoz-Garzón leg.; CZUT-IC 10123.

Identification. Whisker-like odontodes on the cheek and at the corner of the snout. Absence of plates ventrally in front of the anus. Caudal fin slightly emarginated to forked. Dark spots in the dorsal fin (Armbruster 2005).

***Sturisomatichthys leightoni* (Regan, 1912)**
Figure 4A

Material examined. COLOMBIA • 13, 32.8–69 mm SL; Río Alvarado-Caldas Viejo; 04°36′41.2″N, 074°55′46.2″W; 351 m a.s.l.; 19 Sep. 2012; Cristhian C. Conde-Saldaña, Juan G. Albornoz-Garzón leg.; CZUT-IC 10063. • 19, 24.3–92.3 mm SL; Río Alvarado-Caldas Viejo; 04°36′41.2″N, 074°55′46.2″W; 351 m a.s.l.; 19 Sep. 2012; Cristhian C. Conde-Saldaña, Juan G. Albornoz-Garzón leg.; CZUT-IC 10082.

Identification. Reticulations on predorsal, supraoccipital, and interorbital regions. Rostrum present. Cleithral width: 11.0–14.1% SL. Coalescent plates 13–16. Dorsal, pectoral, pelvic, and anal fins lacking filaments. A thin dorsolateral stripe discontinuous and ill-marked present. Dorsal, pectoral, pelvic, and anal fins lacking large, dark blotches occupying almost the entire fin (Londoño-Burbano and Reis 2019).

Family Astroblepidae

***Astroblepus grixalvii* Humboldt, 1805**
Figure 4B

Material examined. COLOMBIA • 11, 25.0–102.7 mm SL; Quebrada Cocare; 04°28′37.4″N, 075°08′25.4″W; 1057 m a.s.l.; 13 Dec. 2012; Juan G. Albornoz-Garzón, Cristhian C. Conde-Saldaña leg.; CZUT-IC 10500. • 6, 51.7–139.8 mm SL; Quebrada Cocare; 04°28′37.4″N, 075°08′25.4″W; 1057 m a.s.l.; 5 Apr. 2013; Juan G. Albornoz-Garzón, Cristhian C. Conde-Saldaña leg.; CZUT-IC 10665.

Identification. Relatively large size (largest specimen 140 mm SL). Premaxillary teeth unicuspid. Adipose fin long and deep with a short spine embedded into the posterior region of fin, posterior fin margin continuous with first caudal-fin ray. First pectoral and dorsal-fin rays extended as filaments. Caudal fin truncated. Upper and lower unbranched caudal-fin rays extended as filaments. Body brownish with greenish tone, dark scattered spots and blotches on head and body (Briñez-Vásquez 2011).

***Astroblepus homodon* (Regan, 1904)**
Figure 4C

Material examined. COLOMBIA • 32, 20.1–54.4 mm SL; Quebrada Chumba; 04°29′06.2″N, 075°05′48.6″W; 973 m a.s.l.; 20 Sep. 2012; Juan G. Albornoz-Garzón, Cristhian C. Conde-Saldaña leg.; CZUT-IC 10275. • 43, 19.2–59.3 mm SL; Quebrada Cocare; 04°28′37.4″N, 075°08′25.4″W; 1057 m a.s.l.; 5 Apr. 2013; Juan G. Albornoz-Garzón, Cristhian C. Conde-Saldaña leg.; CZUT-IC 10666.

Identification. Relatively medium size (largest specimen 71.4 mm SL). Premaxillary teeth bicuspid. Head and predorsal region covered with small papillae. Adipose fin short and thick, with a visible spine covered with odontodes, posteriorly connected to caudal peduncle by a membrane. First dorsal-fin ray not extended as a filament. Ventral-fin origin well in advance of the dorsal-fin origin. Caudal fin with distal margin concave, upper and lower unbranched caudal-fin rays extended as filaments. Body light brown with black scattered spots and blotches on head and body, sometimes with a small yellow blotch on the adipose-spine base (Regan 1904).

***Astroblepus* sp.**
Figure 4D

Material examined. COLOMBIA • 5, 21.6–65.7 mm SL; Quebrada Cocare; 04°28′37.4″N, 075°08′25.4″W; 1057 m a.s.l.; 12 Dec. 2012; Juan G. Albornoz-Garzón, Cristhian C. Conde-Saldaña leg.; CZUT-IC 10502. • 6, 33.0–64.8 mm SL; Quebrada Cocare; 04°28′37.4″N, 075°08′25.4″W; 1057 m a.s.l.; 5 Apr. 2013; Juan G. Albornoz-Garzón, Cristhian C. Conde-Saldaña leg.; CZUT-IC 10667.

Identification. Relatively medium size (largest specimen 67 mm SL). Premaxillary teeth incisiform. Head and predorsal region covered with small papillae. Adipose fin

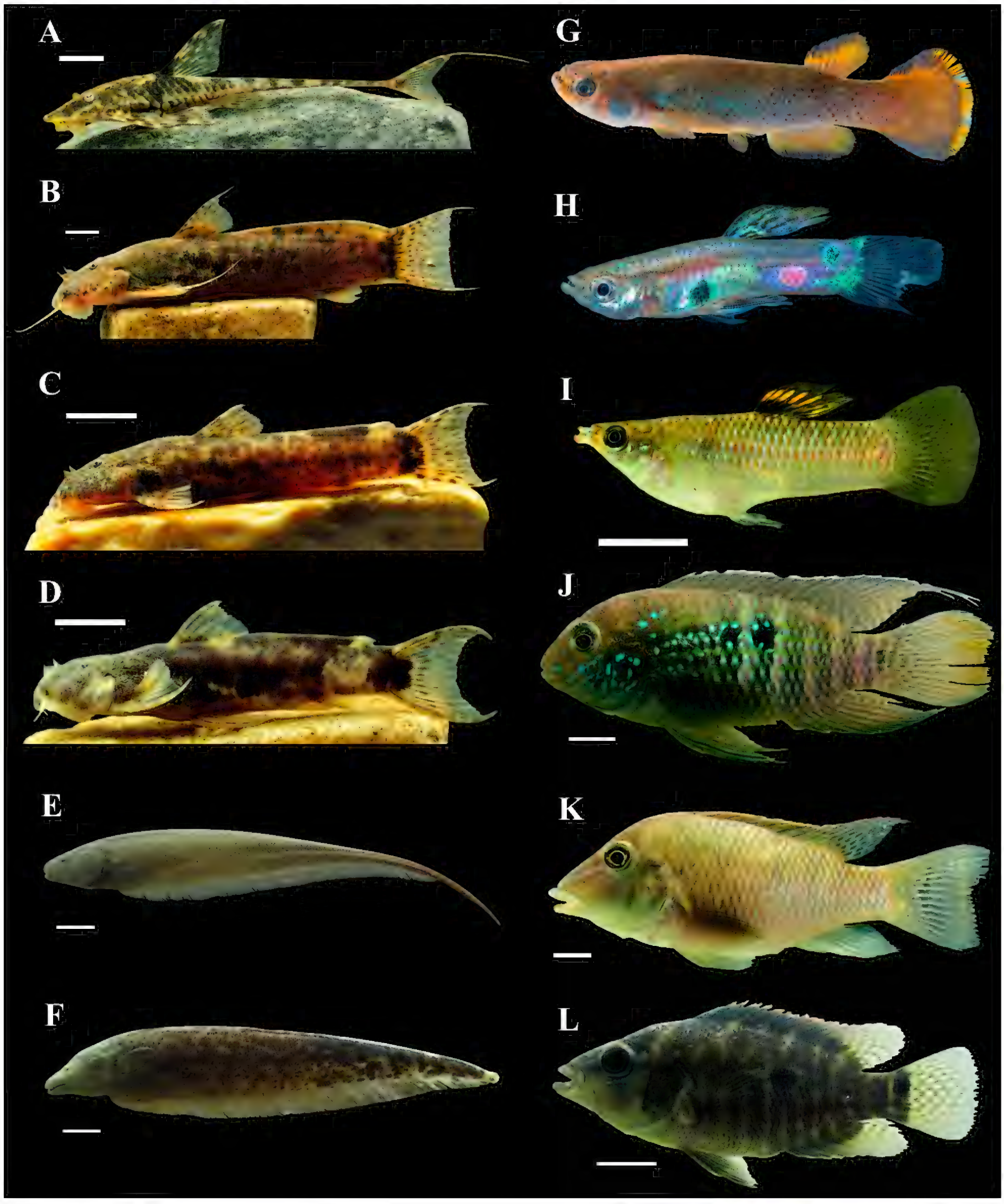

Figure 4. Fishes from Río Alvarado drainage, Upper Río Magdalena Basin, Colombia. **A–D.** Siluriformes. **A.** *Sturisomatichthys leightoni.* **B.** *Astroblepus grixalvii.* **C.** *Astroblepus homodon.* **D.** *Astroblepus* sp. **E–F.** Gymnotiformes: **E.** *Sternopygus aequilabiatus.* **F.** *Apteronotus eschmeyeri.* **G–I.** Cyprinodontiformes. **G.** *Rivulus* (*Cynodonichthys*) *magdalenae* (male). **H.** *Poecilia reticulata* (male). **I.** *Poecilia sphenops* (male) **J–L.** Cichliformes. **J.** *Andinoacara latifrons.* **K.** *Geophagus steindachneri.* **L.** *Kronoheros umbrifer.* Scale bars: 10 mm.

short and thick, with a visible spine covered with odontodes, posteriorly connected to caudal peduncle by a membrane. First dorsal-fin ray not extended as a filament. Caudal fin with distal margin deeply concave, upper and lower unbranched caudal-fin rays extended as filaments. Body dark, with a light blotch at middle of caudal peduncle, variable in size, sometimes with a light blotch at posterior region of dorsal-fin base. Fins with dark spots.

Order Gymnotiformes
Family Sternopygidae

***Sternopygus aequilabiatus* Humboldt, 1805**
Figure 4E

Material examined. COLOMBIA • 1, 181 mm TL; Río

Alvarado-Caldas Viejo; 04°36′41.2″N, 074°55′46.2″W; 351 m a.s.l.; 12 Dec. 2012; Cristhian C. Conde-Saldaña, Juan G. Albornoz-Garzón leg.; CZUT-IC 10353. • 3, 249–314 mm TL; Río Alvarado-Caldas Viejo; 04°36′41.2″N, 074°55′46.2″W; 351 m a.s.l.; 12 Dec. 2012; Cristhian C. Conde-Saldaña, Juan G. Albornoz-Garzón leg.; CZUT-IC 10367.

Identification. Dorsal margin of snout profile strongly concave. Pectoral fin length: 44–53% HL. Head length: 13–16% LEA. Branchial opening: 20–28% HL. Dark humeral spot absent or very diffuse (Hulen et al. 2005).

Family Apteronotidae

***Apteronotus eschmeyeri* de Santana, Maldonado-Ocampo, Severi & Mendes, 2004**
Figure 4F

Material examined. COLOMBIA • 1, 131.8 mm SL; Río Alvarado-Caldas Viejo; 04°36′41.2″N, 074°55′46.2″W; 351 m a.s.l.; 19 Sep. 2012; Cristhian C. Conde-Saldaña, Juan G. Albornoz-Garzón leg.; CZUT-IC 10090. • 1, 86.2 mm SL; Río Alvarado-Caldas Viejo; 04°36′41.2″N, 074°55′46.2″W; 351 m a.s.l.; 28 Jun. 2013; Cristhian C. Conde-Saldaña, Juan G. Albornoz-Garzón leg.; CZUT-IC 10692.

Identification. Mouth rictus extends to beyond the posterior margin of eyes. Body blotchy. A clear band from chin to the beginning of dorsal mid-sagittal electroreceptor organ. Two clear bands surrounding the caudal peduncle in specimens (up to 165 mm TL); bands become obscured by pigment blotching in specimens larger than 165 mm (de Santana et al. 2004).

Order Cyprinodontiformes
Family Rivulidae

***Rivulus* (*Cynodonichthys*) *magdalenae* Eigenmann & Henn, 1916**
Figure 4G

Material examined. COLOMBIA • 11, 16.9–45.7 mm SL; Quebrada La Manjarres; 04°28′19.3″N, 075°04′26.9″W; 758 m a.s.l.; 19 Sep. 2012; Juan G. Albornoz-Garzón, Cristhian C. Conde-Saldaña leg.; CZUT-IC 10208. • 13, 19.9–44.6 mm SL; Quebrada La Manjarres; 04°28′19.3″N, 075°04′26.9″W; 758 m a.s.l.; 12 Dec. 2012; Juan G. Albornoz-Garzón, Cristhian C. Conde-Saldaña leg.; CZUT-IC 10439.

Identification. Head scaled, except for cheek. Mouth superior. Longitudinal series of scales 40–42. Body coloration of live males brown, sides of body bluish, from humeral region to caudal peduncle, with a lateral irregular series of red spots. Dorsal and anal fins with red spots on basal half, distal half yellow with thin dark purple band on distal margin. Caudal fin dark purple along procurrent rays, distal portion yellow and white. Pectoral and pelvic fins yellowish. Body coloration of live females brown, with scattered dark blotches along sides. Dorsal and anal fins with dark spots. Pelvic and pectoral fins hyaline. A dark spot on upper portion of caudal peduncle (Henn 1916).

Family Poeciliidae

***Poecilia reticulata* Peters, 1859**
Figure 4H

Material examined. COLOMBIA • 10, 11.7–24.3 mm SL; Quebrada La Manjarres; 04°28′19.3″N, 075°04′26.9″W; 758 m a.s.l.; 19 Sep. 2012; Juan G. Albornoz-Garzón, Cristhian C. Conde-Saldaña leg.; CZUT-IC 10209. • 8, 15.9–23.7 mm SL; Quebrada La Manjarres; 04°28′19.3″N, 075°04′26.9″W; 758 m a.s.l.; 12 Dec. 2012; Juan G. Albornoz-Garzón, Cristhian C. Conde-Saldaña leg.; CZUT-IC 10434.

Identification. Dorsal-fin rays 6–7. Gonopodium with a retrorse hook on ray 5. The fleshy palp elongated, extending well beyond the tip. Ventral spines on the third gonopodial ray large, giving the gonopodium a bulb-like appearance. Body silvery, with dots, stripes and blotches (only in males) (Poeser 2003).

***Poecilia sphenops* Valenciennes, 1846**
Figure 4I

Material examined. COLOMBIA • 11, 10.7–33.9 mm SL; Quebrada La Caima; 04°35′45.8″N, 075°56′39.6″W; 374 m a.s.l.; 19 Sep. 2012; Cristhian C. Conde-Saldaña, Juan G. Albornoz-Garzón leg.; CZUT-IC 10126. • 7, 11.8–28.4 mm SL; Río Alvarado-Chucuní; 04°27′56.7″N, 075°03′46.7″W; 697 m a.s.l.; 19 Sep. 2012; Juan G. Albornoz-Garzón, Cristhian C. Conde-Saldaña leg.; CZUT-IC 10243.

Identification. Dorsal-fin rays 9–10. Blueish and reddish spots (males), extending from humeral region to caudal peduncle in the body sides. Dorsal fin with a yellow spot surrounded by two or three black bands (Poeser 2003).

Order Cichliformes
Family Cichlidae

***Andinoacara latifrons* (Steindachner, 1878)**
Figure 4J

Material examined. COLOMBIA 2, 53.4–58.2 mm SL; Río Alvarado-Caldas Viejo; 04°36′41.2″N, 074°55′46.2″W; 351 m a.s.l.; 19 Sep. 2012; Cristhian C. Conde-Saldaña, Juan G. Albornoz-Garzón leg.; CZUT-IC 10110. • 3, 41.6–45.4 mm SL; Quebrada La Caima; 04°35′45.8″N, 075°56′39.6″W; 374 m a.s.l.; 4 Apr. 2013; Juan G. Albornoz-Garzón, Cristhian C. Conde-Saldaña leg.; CZUT-IC 10582.

Identification. Body moderately deep (36.9–42.5% SL). Snout slightly rounded (25.9–356% HL). Mouth terminal. First gill arch lacking a prominent epibranchial lobe. Scales in E1 11–18 and E2 6–10. Dorsal fin with 14–16 spines and 10–12 soft rays, 5th to 6th ray longest, prolonged as filament. Anal fin with three spines and 7–10 soft rays, 4th to 5th ray longest, prolonged as filament. Caudal fin subtruncate or slightly rounded. In sexually

mature specimens, head and first half body with metallic green spots. Sides of body with nine dark vertical stripes and a dark midlateral spot. A vertically dark blotch in the mid of the caudal-fin base. Dorsal fin dark grey, with light grey bands and narrow white margin. Caudal fin dark grey with distal portion yellowish (Steindachner 1878).

Geophagus steindachneri Eigenmann & Hildebrand, 1910

Figure 4K

Material examined. COLOMBIA • 13, 16.7–44.4 mm SL; Río Alvarado-Caldas Viejo; 04°36′41.2″N, 074° 55′46.2″W; 351 m a.s.l.; 19 Sep. 2012; Cristhian C. Conde-Saldaña, Juan G. Albornoz-Garzón leg.; CZUT-IC 10111. • 11, 13.8–66.7 mm SL; Quebrada La Caima; 04° 35′45.8″N, 075°56′39.6″W; 374 m a.s.l.; 19 Sep. 2012; Cristhian C. Conde-Saldaña, Juan G. Albornoz-Garzón leg.; CZUT-IC 10159.

Identification. Body deep (38.1–41.8% SL). Snout moderately pointed (43.4–59.6 % HL). Mouth subterminal and protractile. First gill arch with prominent epibranchial lobe. Scales in E1 19–20 and E2 13. Dorsal fin with 16 spines and 13 soft rays, 4th to 5th ray longest, extended as filaments. Anal fin with three spines and 7–8 soft rays. Caudal fin with distal margin concave. Body coloration brown or light brown. Sides of body with six faint dark vertical stripes. A vertically dark blotch at middle of caudal-fin. Dorsal fin dark grey, with light dark bands in soft rays. Caudal fin hyaline with dark spots. Pectoral fin dark grey. Pelvic and anal fins pale grey or hyaline (Eigenmann 1922).

Kronoheros umbrifer (Meek & Hildebrand, 1913)

Figure 4L

Material examined. COLOMBIA • 1, 31.5 mm SL; Río Alvarado-Puente; 04°31′11.3″N, 074°59′14.0″W; 521 m a.s.l.; 19 Sep. 2012; Juan G. Albornoz-Garzón, Cristhian C. Conde-Saldaña leg.; CZUT-IC 10178. • 1, 54.9 mm SL; Río Alvarado-Caldas Viejo; 04°36′41.2″N, 074° 55′46.2″W; 351 m a.s.l.; 28 Jun. 2013; Cristhian C. Conde-Saldaña, Juan G. Albornoz-Garzón leg.; CZUT-IC 10716.

Identification. Body deep. Snout moderately pointed. Mouth terminal. First gill arch lacking epibranchial lobe. Scales in E1 20–23 and E2 10–13. Dorsal fin with 16–17 spines and 11–12 soft rays. Anal fin with 6–7 spines. Caudal fin rounded. Sides of body with 11 dark vertical stripes and a dark midlateral spot. A vertical dark blotch at middle of caudal-fin. Dorsal fin dark grey, with narrow red margin along distal portion of spines, soft rays hyaline. Caudal fin hyaline with dark spots. Pectoral fin hyaline. Pelvic and anal fins dark with distal portion hyaline (Meek and Hildebrand 1913).

Identification key to orders, families, and species from Río Alvarado drainage, Upper Río Magdalena Basin, Colombia

1 Body covered with scales; barbels absent 2
1′ Body naked or covered with bony plates; barbels present ..... Siluriformes

2. Fins without spines; lateral line complete or incomplete 3
2′ Fins with spines; lateral line interrupted ..... Cichliformes

3 Dorsal and pelvic fins present 4
3′ Dorsal and pelvic fins absent ..... Gymnotiformes
4 Upper jaw not protrusible; adipose fin present (except Erythrinidae) ..... Characiformes
4′ Upper jaw protrusible; adipose fin absent ..... Cyprinodontiformes

Characiformes

1 Upper lip present; premaxilla with conical or multicuspid teeth 2
1′ Upper lip absent; premaxilla with spatulate teeth ..... Parodontidae: *Parodon magdalenensis* (Fig. 2C)

2 Pectoral-fin with one unbranched ray 3
2′ Pectoral-fin with two or more unbranched rays ..... Crenuchidae: *Characidium phoxocephalum* (Fig. 2A)

3 Adipose fin present; caudal fin not rounded ..... Characidae: 4
3′ Adipose fin absent; caudal fin rounded ..... Erythrinidae: *Hoplias malabaricus* (Fig. 2B)

4 Mouth without external teeth on premaxilla 5
4′ Mouth with external teeth on premaxilla ..... *Roeboides dayi* (Fig. 2L)

5 Mouth with four teeth on inner premaxillary row; fins usually yellowish or dark 6
5′ Mouth with five teeth on inner premaxillary row; fins usually reddish ..... *Astyanax* sp. (Fig. 2D)

6 Mouth subterminal; anal fin with 13 or fewer branched rays 7
6′ Mouth terminal or superior; anal fin with more than 13 branched rays 10

7 Mouth with three irregular rows of premaxillary teeth 8
7′ Mouth with two rows of premaxillary teeth ..... *Microgenys minuta* (Fig. 2K)

8 Eye diameter less than 26.8% of head length; third infraorbital not in contact with preopercle ..... *Creagrutus dulima* (Fig. 2G)
8′ Eye diameter more than 27.2% of head length; third infraorbital in contact with preopercle 9

9 Middle caudal-fin rays with dark stripe; humeral blotch vertically elongated; anal fin usually with 11 to 13 branched rays ..... *Creagrutus affinis* (Fig. 2F)
9′ Middle caudal-fin rays without dark stripe; humeral

blotch ovoid; anal fin usually with 9 to 11 branched rays ..... *Creagrutus magdalenae* (Fig. 2H)

10 Mouth superior; dorsal-fin origin behind anal-fin origin..... *Gephyrocharax melanocheir* (Fig. 2I)

10′ Mouth terminal; dorsal-fin origin anterior to anal-fin origin 11

11 Anal fin with more than 30 branched rays; caudal fin without horizontal dark stripe; males with a pouch of scales at base of caudal fin .... *Argopleura magdalenensis* (Fig. 2E)

11′ Anal fin with less than 30 branched rays; caudal fin with horizontal dark stripe; males without a pouch of scales at base of caudal fin .... *Hemibrycon* sp. (Fig. 2J)

Siluriformes

1 Body naked..... 2

1′ Body covered with plates ..... Loricariidae: 6

2 Mouth ventral; oral disk present .... Astroblepidae: 10

2′ Mouth terminal or subterminal; oral disk absent 3

3 Adipose fin present..... 4

3′ Adipose fin absent..... Trichomycteridae: 12

4 Dendritic pattern of lateral line tubes in skin of snout, cheek and nape; posterior supraoccipital process contacting nuchal plate 5

4′ Simple pattern of lateral line tubes in skin of snout, cheek and nape; posterior supraoccipital process not contacting nuchal plate ..... Heptapteridae (except *Pimelodella floridablancaensis*): 14

5 Dark lateral stripe along body; dorsal surface of head smooth ..... Heptapteridae: *Pimelodella floridablancaensis* (Fig. 3B)

5′ Dark lateral stripe along body absent; dorsal surface of head rough..... Pimelodidae: *Pimelodus yuma* (Fig. 3E)

6 Caudal fin with 12 or more rays; adipose fin present 7

6′ Caudal fin with 12 rays; adipose fin absent .... *Sturisomatichthys leigthoni* (Fig. 4A)

7 Abdomen naked; teeth villiform..... 8

7′ Abdomen with plates; teeth spoon-shaped .... *Hypostomus* (*Cochliodon*) *hondae* (Fig. 3K)

8 Anterior region of snout naked; whisker-like odontodes on cheek absent..... 9

8′ Anterior region of snout covered with plates; whisker-like odontodes on cheek .... *Lasiancistrus caucanus* (Fig. 3L)

9 Head and body gray, usually with small dark spots; caudal fin with undulated dark stripe at distal margin..... *Chaetostoma milesi* (Fig. 3I)

9′ Head and body dark brown, sometimes with light spots; caudal fin without undulated dark stripe at distal margin ..... *Chaetostoma thomsoni* (Fig. 3J)

10 Adipose fin long and deep, with short spine embedded in posterior region; first pectoral-fin ray and first dorsal-fin ray prolonged as filaments .... *Astroblepus grixalvii* (Fig. 4B)

10′ Adipose fin short and low, with visible spine covered with odontodes; first pectoral-fin ray and first dorsal-fin ray not prolonged as long filaments..... 11

11 Premaxillary teeth bicuspid; body light brown with black scattered spots and blotches, sometimes with small yellow blotch on adipose-spine base..... ..... *Astroblepus homodon* (Fig. 4C)

11′ Premaxillary teeth incisiform; body usually dark, with variable light blotch on middle of caudal peduncle, sometimes with light blotch on posterior region of dorsal-fin base ..... *Astroblepus* sp. (Fig. 4D)

12 Head squared in dorsal view, dark lateral band well defined on body .... *Trichomycterus transandianus* (Fig. 3G)

12′ Head triangular in dorsal view, dark lateral band absent..... 13

13 Body with a series of dark lateral spots, usually larger than eye; premaxilla with 27 teeth; dentary with 30 teeth ..... *Trichomycterus banneaui* (Fig. 3F)

13′ Body with dark spots, usually smaller than eye; premaxilla with 37 teeth; dentary with 37 teeth .... *Trichomycterus mogotensis* (Fig. 3H)

14 Maxillary barbel not reaching pelvic-fin insertion; adipose fin short (<30% SL), adipose-fin origin equidistant between dorsal fin and caudal fin; body with conspicuous transverse pale bands 15

14′ Maxillary barbel reaching pelvic-fin insertion; adipose fin long (>39% SL), adipose-fin origin closer to dorsal fin than the caudal fin; body variably pigmented, sometimes dark or light brown, often with a dark lateral stripe along lateral line .... *Rhamdia guatemalensis* (Fig. 3C)

15 Adipose fin triangular; caudal-fin lobes pointed; body with conspicuous pale transverse bands .... *Cetopsorhamdia molinae* (Fig. 3A)

15′ Adipose fin rounded; caudal-fin lobes rounded; body with conspicuous pale band behind head and in front of dorsal fin .....Heptapteridae undescribed (Fig. 3D)

Gymnotiformes

17 Caudal fin present; body blotched.....Apteronotidae: *Apteronotus eschmeyeri* (Fig. 4F)

17′ Caudal fin absent; body uniformly dark ..... Sternopygidae: *Sternopygus aequilabiatus* (Fig. 4E)

Cyprinodontiformes

1 Pectoral fin with all rays branched; dorsal and anal fins origin posteriorly placed; anal fin in males not modified into a gonopodium ..... Rivulidae: *Rivulus* (*Cynodonichthys*) *magdalenae* (Fig. 4G)

1′ Pectoral fin having unbranched rays; dorsal and anal fins placed on middle of body; males with anal fin modified into a gonopodium ..... Poeciliidae: 2

2 Dorsal fin with dark spots; body without dark dots and blotches (in both sexes)... *Poecilia sphenops* (Fig. 4H)
2′ Dorsal fin without dark spots; body usually with dark dots and blotches (only in males)..... ..... *Poecilia reticulata* (Fig. 4I)

Cichliformes

1 Dorsal fin with 15–16 spines; midlateral blotch and caudal ocellus present..... .....*Kronoheros umbrifer* (Fig. 4L)
1′ Dorsal fin with 9–11 spines; midlateral blotch and caudal ocellus absent.....2
2 Scales covering half-length of caudal fin; fleshy lobe in upper region (epibranchial) of first gill arch .... *Geophagus steindachneri* (Fig. 4K)
2′ Scales covering one-third of length of caudal fin; fleshy lobe in upper region (epibranchial) of first gill arch absent..... *Andinoacara latifrons* (Fig. 4J)

Discussion

We recorded 36 species in the Río Alvarado drainage, which represents about 16.6% of the total species of the Magdalena-Cauca system (DoNascimiento et al. 2019) and 29.6% of the Upper Río Magdalena (Villa-Navarro et al. 2006). The taxonomic composition did not differ from the general pattern described for South American freshwater fishes, given the predominance of Characiformes and Siluriformes (Reis et al. 2016; Dagosta and de Pinna 2019). Particularly, this pattern is also in accordance with other drainages from the Upper Magdalena Basin (Montoya-Ospina et al. 2018).

We found a number of species similar to that reported in other rivers draining into the Tropical Dry Forest ecosystem. For instance, Río Anchique drainage (36 spp.), Río Opia drainage (38 spp.) and Río Venadillo drainage (34 spp.) (López-Delgado 2013; Montoya-Ospina et al. 2018). On the other hand, the greater abundance of *Trichomycterus banneaui* (19.4%) and *Creagrutus affinis* (13%) in the Río Alvarado drainage is in accordance to the observed by Montoya-Ospina et al. (2018) in the Río Anchique drainage, where both species were also the most abundant. The high abundance of these species may due to their opportunistic life strategies, specifically, their small adult body size, rapid sexual maturity, and a high reproductive effort (Winemiller 1989, 2005; Winemiller et al. 2008).

Among the species found in our study, four are categorized as threatened: *Characidium phoxocephalum* as vulnerable, and *Kronoheros umbrifer*, *Hypostomus hondae*, and *Microgenys minuta* as near threatened (Mojica et al. 2012). Likewise, we found two non-native species along the basin, *Poecilia reticulata* and *P. sphenops* which are invasive species widely distributed in aquatic environments, due to its use as biological control for diseases vectored by mosquitoes, as well as ornamental aquarium fish (Axelrod et al. 1986; Chandra et al. 2008). The impacts of the invasive poeciliids on the aquatic natural communities have been well documented and include changes in the trophic network by predation of the macroinvertebrate assemblage (Holliztki et al. 2013; Walton et al. 2016), disturbances in the population of native fishes by predation of eggs or juveniles stages (Stockwell and Henkanaththegedara 2011; Schumann et al. 2015), territoriality (Warburton and Madden 2003), and hybridization (de Brito et al. 2013). Considering these documented effects resulting from its introduction in non-native areas, we consider necessary to study the life history of local populations of *P. reticulata* and *P. sphenops* of the Río Alvarado drainage, with the objective to adequately evaluate the level of negative effects on the structure and dynamics of native fish communities.

On the other hand, the Río Magdalena Basin has been historically the hydrographic system of Colombia with the largest loss of habitat and disturbances (Galvis and Mojica 2007; Barletta et al. 2010; Jimenez-Segura et al. 2016). Particularly, the Upper Magdalena Basin is not the exception, as evidenced in the Tropical Dry Forest biome, which has been intensely fragmented for agriculture and cattle (Forero-Medina and Joppa 2010). The sampling campaigns of this study were carried out seven years ago and some environmental conditions along the Río Alvarado drainage could have changed since then due to continuous anthropogenic activities, as deforestation, land use, and water pollution. The effects of these human activities mainly include changes related to habitat heterogeneity (Bojsen and Barriga 2002; Cassatti et al. 2012) and loss of functional and species diversity (Ferreira et al. 2018; Zeni et al. 2019). Accordingly, this raises interest to assess if the composition noted in this study has changed through time.

In conclusion, our study intends through provision of an annotated list to be the first step to improve our knowledge of the fishes from trans-Andean small drainages. However, with the alarming high rate of habitat loss along the Río Magdalena Basin is necessary that environmental authorities implement management measures to sustain habitat quality of small drainages, which can be acting as refuges of fishes at regional scales.

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Authors' Contributions

JGAG, CCCS and EOLD collected the specimens; JGAG and CCCS identified the specimens; JEGM and CCCS photographed the specimens; JGAG, CCCS and FAVN wrote the manuscript; all authors reviewed the text.

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